

Factors Contributing to Structural Change

Variation in Production Costs

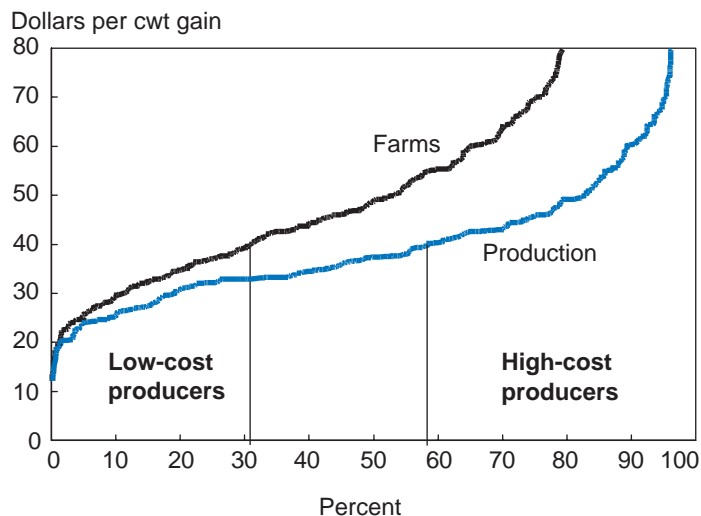
Average hog production cost estimates reveal limited information about the economic performance of U.S. hog producers. Considerable production cost variability exists among hog producers. Lawrence reports total production costs that were about \$10 per cwt lower, or more than 20 percent, for the highest profit one-third of Iowa producers, compared with the lowest profit one-third. Similarly, total costs among farrow-to-finish producers in Kansas were \$14 per cwt less for the top one-third of producers relative to the bottom one-third, a difference of nearly 30 percent (Langemeier and Schroeder). Such cost differences are important to the structure of hog production. In a survey of former hog producers in Iowa, economic factors, including costs of production, were the top four reasons that producers exited the hog industry between 1991 and 1997 (Lawrence and Wang). Government statistics on the number of hog farms show that more than 15,000 operations (about 14 percent) quit producing hogs between 1998 and 1999 (NASS, *Hogs and Pigs*), corresponding to a prolonged period of hog prices that were likely below the production costs of many operations.

This report examines cost variation among U.S. hog producers by dissecting the distribution of costs for the different types of producers. Estimated production costs per cwt gain (see Glossary, p. 43) for each producer type were ranked from lowest to highest to form a weighted cumulative distribution. The cost estimates were expressed per unit of the primary product of each type of operation, either market hogs or feeder pigs, by deducting the value of secondary products, mainly cull or breeding stock, from costs.⁶ Thus, production costs can be directly compared with market hog or feeder pig prices. Figure 7 illustrates the cumulative distribution of farrow-to-finish production costs. At a market price of \$40 per cwt, only about 30 percent of farrow-to-finish producers were able to cover costs in 1998. However, these producers accounted for nearly 60 percent of total production from farrow-to-finish operations.

The cumulative distribution was divided into quartiles, with the bottom quartile representing hog producers with the lowest costs, and the top quartile representing hog producers with the highest costs (fig. 7). Factors that may

Figure 7
Cumulative distribution of farrow-to-finish production costs per cwt gain, 1998

At a market price of \$40/cwt for hogs, only about 30 percent of producers covered costs, but they produced nearly 60 percent of total production.



Source: 1998 Agricultural Resource Management Survey.

have contributed to the relative costs of low- and high-cost producers were identified by comparing the structural and performance characteristics of each group.

Structural Characteristics by Cost Group

Low-cost operations were significantly larger than high-cost operations among all producer types. The 25 percent of operations with the lowest costs accounted for more than 40 percent of production (71 percent of feeder pig production), while the 25 percent of producers with the highest costs comprised less than 10 percent of production among the producer types (table 2). Low-cost farrow-to-finish operations produced more than 2,000 head of market hogs per farm, compared with 370 head on high-cost operations. The difference was even greater among specialized producer types where low-cost feeder pig operations produced more than 16,000 head per farm and low-cost hog finishers produced about 4,300 head. This compares to 754 feeder pigs and 615 finished hogs on the high-cost operations. Also, more of the hogs produced by low-cost producers on specialized operations were removed under contract than on high-cost operations. Over 90 percent of the pigs were removed under contract from low-cost feeder pig operations, while 56 percent of hogs were removed under contract from low-cost hog finishing operations. Farms with low-cost hog operations were also organized to be more highly specialized in hog production compared with high-cost operations. Almost

⁶ This method of presenting the unit-cost of production has been referred to as the Residual Claimant method (Frank).

Table 2—Characteristics by cost group for hog producer types, 1998

Item	Low-cost producers	High-cost producers
Farrow-to-finish		
Percent of farms/sales and removals	25/46	25/8
Hogs and pigs sold or removed (head)	2,180	370*
Head removed under contract (percent)	1**	id
Farm production value from hogs (percent)	58	26
Farm typology (percent of farms):		
Retirement	id	14**
Residential lifestyle	4*	22*
Farming occupation-lower sales	18*	25*
Farming occupation-higher sales	44	28*
Large family farm	18*	9**
Very large family farm	15	1**
Farm debt-to-assets ratio	0.18	0.18
Operator age (years)	48	56
Exiting industry in 1 year or less (percent)	20	40
Farrow-to-feeder pig		
Percent of farms/sales and removals	25/71	25/3
Hogs and pigs sold or removed (head)	16,618**	754**
Head removed under contract (percent)	92	70**
Farm production value from hogs (percent)	93	54*
Farm typology (percent of farms):		
Retirement	0	id
Residential lifestyle	11**	37
Farming occupation-lower sales	26*	48*
Farming occupation-higher sales	21*	5**
Large family farm	9**	id
Very large family farm	34**	3**
Farm debt-to-assets ratio	0.48*	0.17*
Operator age (years)	47	55
Exiting industry in 1 year or less (percent)	17**	52
Feeder pig-to-finish		
Percent of farms/sales and removals	25/41	25/6
Hogs and pigs sold or removed (head)	4,301	615
Head removed under contract (percent)	56	34*
Farm production value from hogs (percent)	64	24
Farm typology (percent of farms):		
Retirement	id	id
Residential lifestyle	16*	19*
Farming occupation-lower sales	id	15*
Farming occupation-higher sales	26*	42*
Large family farm	22*	16*
Very large family farm	30	8*
Farm debt-to-assets ratio	0.35	0.21
Operator age (years)	49	50
Exiting industry in 1 year or less (percent)	21*	36*

Notes: id indicates insufficient data for legal disclosure; single (*) and double asterisks (**) indicate a coefficient of variation between 25 and 50, and greater than 50, respectively. The definition of low- and high-cost producers can be found in the Glossary, p. 43.

60 percent of the total farm production value on low-cost farrow-to-finish and finishing operations was from the hog enterprise, while more than 90 percent was from the hog enterprise on low-cost feeder pig operations.

The relative diversity of low- and high-cost hog operations is illustrated from the distribution by farm typology

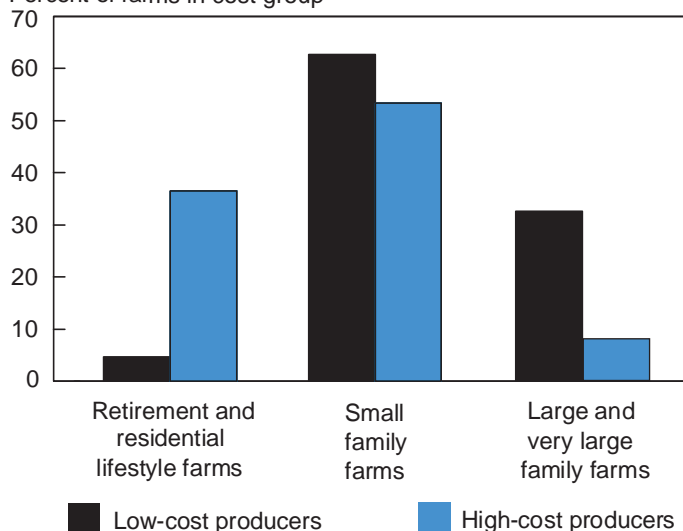
(see Glossary, p. 43). Differences in typology are a reflection of operators' expectations and goals from farming, stage in the life cycle, and dependence on agriculture, as well as size of operation (Hoppe, Perry, and Banker). Significantly more of the high-cost producers were retirement and residential lifestyle farms, comprising more than a third of farrow-to-finish (fig. 8) and feeder pig opera-

Figure 8

Distribution of farrow-to-finish producers by farm typology, 1998

Retirement and residential lifestyle farms were mostly high-cost producers, while large and very large family farms were mostly low-cost producers.

Percent of farms in cost group



Source: 1998 Agricultural Resource Management Survey.

tions. Because operations of these types depend relatively less on farming for income, they likely have less time for farming and different goals for the farm operation. Also, retirement operations have a shorter planning horizon and are likely to be using production technologies (e.g., buildings and equipment) closer to the end of their useful life, which may contribute to lower performance. Low-cost operations were more often large or very large farms that have a considerable time and financial investment in farming. Thirty percent or more of the low-cost feeder pig and hog finishing operations were very large farms, and these producers had a considerably greater financial investment in farming as indicated by a higher debt-to-asset ratio than among the high-cost producers (table 2).

Many low-cost producers were also significantly younger than were the high-cost producers. The average age on farrow-to-finish and feeder pig operations was about 8 years less among low-cost producers. With more retirement farms and older farm operators, many more high-cost producers reported plans to exit hog production in 1 year or less. Also, market hog prices during 1998 reached record lows in December (USDA, NASS, *Agricultural Prices*). Declining hog prices mean that more of the high-cost operations would have produced at a loss, providing an incentive for these producers to consider leaving the hog business.

Performance by Cost Group

Most indicators of physical and economic performance were significantly better on low-cost than on high-cost hog operations (table 3). A major difference between the groups was that low-cost producers were able to generate much greater output from the capital invested (breeding stock and facilities) in the hog operation. Low-cost farrow-to-finish and feeder pig producers farrowed more litters per sow, and produced about four times more litters per sow capacity of the farrowing facilities. This may have been achieved by weaning pigs at a younger age and lower weight, freeing up facility space for more litters. Also, many high-cost producers were likely operating well below total capacity.

Feed and labor efficiency on low-cost operations was also significantly greater than on high-cost operations. Less feed per unit resulted in considerable cost savings for low-cost operations of all producer types. Better feed efficiency also meant that low-cost producers could have finished hogs in fewer days, thus freeing up space to move more hogs through the finishing facilities.⁷ Low-cost farrow-to-finish and finishing operations produced nearly twice the hogs per head of finishing capacity than on high-cost operations. Because the farrowing and finishing facilities were used much more efficiently on low-cost operations, asset ownership costs were lower as fixed costs were spread over more units of production.

Greater productivity on low-cost operations was made possible by, among other factors, newer technologies. The average age of farrowing facilities was less on low-cost operations, particularly among feeder pig producers where the facilities were about half as old as those on high-cost operations (fig. 9). Likewise, finishing barns were newer by an average of 7 years on farrow-to-finish operations and 11 years on hog finishing operations. Technical advances make possible the improved care of baby pigs (thus lowering death losses and allowing pigs to be weaned younger), reduce labor requirements per unit of production, and increase feed efficiency by lowering feed losses and improving herd health. These are many of the advantages of low-cost compared with high-cost operations (table 3).

⁷ This was more likely on the farrow-to-finish and feeder pig operations where final hog weights for the low- and high-cost producers were not significantly different. However, low-cost hog finishing operations fed hogs to a heavier weight than high-cost operations (254 versus 246 pounds), and thus may have achieved the added weight gain in about the same number of days on feed.

Table 3—Performance by cost group for hog producer types, 1998

Item	Low-cost producers	High-cost producers
Farrow-to-finish		
Litters farrowed per sow (number)	2.20	2.02
Pigs weaned per litter (head)	8.71	7.18
Pigs weaned per sow (head)	19.19	14.48
Weaning age (days)	29	40
Weaning weight (pounds)	19	28
Feed efficiency (pounds fed per cwt gain)	299	626
Labor efficiency (hours per cwt gain)	0.50	1.92
Litters farrowed per sow capacity	6.53	1.50*
Farrowing facility age (years)	15	17
Hogs finished per head capacity	2.91	1.64*
Finishing facility age (years)	13	21
Production costs (dollars per cwt gain):		
Feed costs	19.27	40.71
Operating costs	25.67	51.33
Ownership costs	8.60	35.65
Total operating and ownership costs	34.26	86.98
Farrow-to-feeder pig		
Litters farrowed per sow (number)	2.33	2.20
Pigs weaned per litter (head)	9.69	7.80
Pigs weaned per sow (head)	22.58	17.18*
Weaning age (days)	25	33
Weaning weight (pounds)	17	22
Feed efficiency (pounds fed per cwt gain)	251	949
Labor efficiency (hours per cwt gain)	0.56**	4.05
Litters farrowed per sow capacity	10.47*	2.54*
Farrowing facility age (years)	7	14*
Production costs (dollars per cwt gain):		
Feed costs	26.18	77.19
Operating costs	47.23	134.11
Ownership costs	20.07*	84.95
Total operating and ownership costs	67.30	219.06
Feeder pig-to-finish		
Feed efficiency (pounds fed per cwt gain)	240	575
Labor efficiency (hours per cwt gain)	0.16	0.78
Hogs finished per head capacity	2.36	1.30
Finishing facility age (years)	6	17
Production costs (dollars per cwt gain):		
Feed costs	15.83	35.98
Operating costs	34.34	66.92
Ownership costs	5.68	14.15
Total operating and ownership costs	40.02	81.08

Notes: Single (*) and double asterisks (**) indicate a coefficient of variation between 25 and 50, and greater than 50, respectively. The definition of low- and high-cost producers can be found in the Glossary, p. 43.

The much higher asset ownership costs estimated for high-cost operations are probably not considered by many of these producers in their production decisions. As previously mentioned, these operators are older than low-cost producers, have older production facilities, and likely have paid for the investment in hog buildings and equipment. At their stage in the life cycle, many high-cost producers will not replace the facilities once their useful life has ended. Annual production decisions for these producers are more likely to be based on operating costs. The much

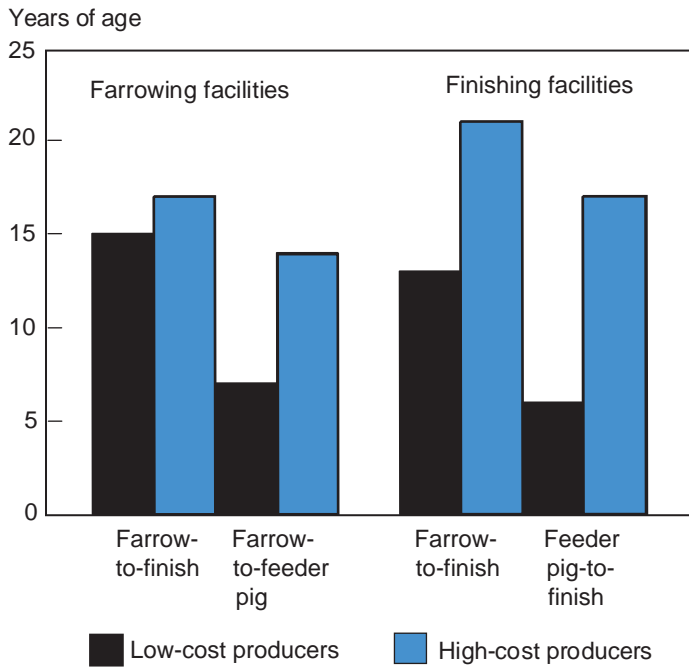
greater operating costs on high-cost operations is likely an important reason why a significant number of the high-cost producers of each producer type reported plans to exit the industry in 1 year or less (see table 2).⁸

⁸ Feed costs for homegrown grain were estimated by valuing the grain at the market price (i.e., its opportunity cost as hog feed). Many of the high-cost producers fed corn produced on the farm and this method for valuing the corn may overstate their actual cost of producing hog feed.

Figure 9

Farrowing and finishing facility age by type of producer, 1998

The facilities used by low-cost producers were significantly newer than those used by high-cost producers, especially among the specialized producer types.



Source: 1998 Agricultural Resource Management Survey.

Economies of Size

This report also examines cost variation among U.S. hog producers by focusing on the cost-size relationship. A commonly held notion is that economies of size exist in U.S. agriculture and that these economies are perhaps the most significant factor in explaining structure (Ahearn, Whittaker, and El-Osta; Boehlje). More specifically, the view is that the most economically efficient size of farms will prosper and other farms will tend to exit or gravitate to that farm size. This view is supported by empirical evidence that indicates an L-shaped relationship between costs and output (Hallam). The trend in farm structure toward fewer and larger hog farms also supports the existence of economies of size in hog production. Census of Agriculture statistics show that the number of hog farms in 1997 dropped by about two thirds from 1982, while the number of hogs produced per farm more than tripled (fig. 10). Expansion in the number of hogs per farm was particularly rapid during the 1990s, increasing from about 300 head per farm in 1992 to more than 550 head in 1997.

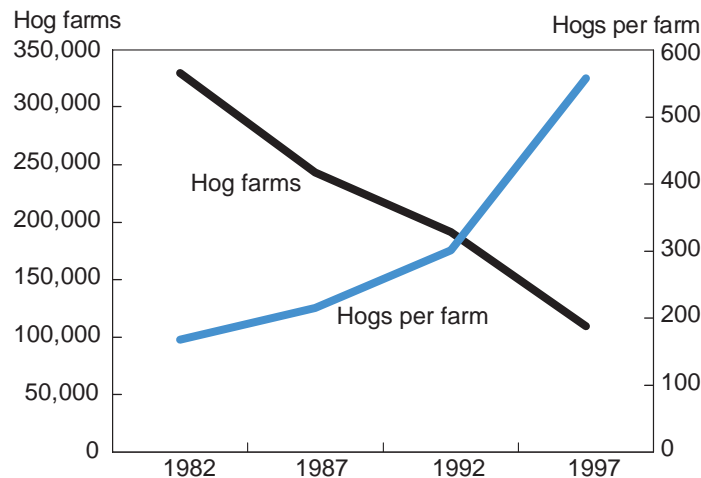
Seckler and Young have offered an alternative explanation for the L-shaped relationship found between average costs and production levels and the increase in farm size over time, other than the existence of economies of size. Their explanation relates to the existence of superior management abilities and the desire to increase net income or wealth. Superior managers, as indicated by profitability, will have the ability and incentive to expand and leave the high-cost producers among the smaller sizes of farms. Boehlje also notes that enhanced managerial ability from investments in human capital increase the “span of control,” allowing farmers to more effectively manage larger scale specialized units. Research by Mueller into Illinois hog production lends support for this view. This research found that size of the hog enterprise alone contributed very little to the profitability per unit of production, as measured by returns above feed costs per litter. The authors concluded that the managerial talent of the producer was much more important to profitability than was size of operation. More recent research examining swine operations in Iowa also suggests that size of operation is not the dominant factor to remaining competitive in hog production (Kliebenstein, Lawrence, and Duffy). Likewise, a comparison of efficiency across farrow-to-finish swine operations in Kansas suggests that small, efficient producers are able to compete on a cost basis with much larger operations (Rowland et al.).

To evaluate the relationship between hog costs of production and size of operation, surveyed producers were divided into discrete size groups and differences in hog

Figure 10

Farms and hogs per farm, 1982-97

The number of hog farms in 1997 was about one-third of that in 1982, while the number of hogs produced per farm more than tripled.



Source: Census of Agriculture, various years.

Table 4—Number of hog operations by size of operation, 1998 and 1999*More than 13,000 small hog operations went out of business between 1998 and 1999.*

Size of operation (head)	Number of operations		
	1998	1999	Change
Small (1-499)	88,985	75,690	-13,295
Medium (500-1,999)	18,175	15,755	-2,420
Large (2,000-4,999)	4,765	5,110	+345
Industrial-scale (5,000+)	1,905	2,055	+150

Source: USDA, NASS, *Hog and Pigs*, 1999.

production costs, and farm structural and performance characteristics were examined. The size groups were assigned according to the reported peak hog inventory on the operation during 1998 into: 1) small operations (1-499 head); 2) medium operations (500-1,999 head); 3) large operations (2,000-4,999 head), and: 4) industrial-scale operations (5,000 head or more). Government statistics (USDA, NASS, *Hogs and Pigs*) indicate that more than 13,000 small hog operations went out of business between 1998 and 1999, while the number of large and industrial-scale operations increased, despite low hog prices during this period (table 4).

Structural Characteristics by Size Group

Small- and medium-sized hog operations far outnumbered large and industrial-scale operations during 1998, but produced a disproportionately small share of total hog production. About half of all farrow-to-finish and feeder pig operations were small, but these small operations produced only 8 percent of farrow-to-finish production and 2 percent of feeder pigs (table 5). Only 3 percent of farrow-to-finish and 5 percent of hog finishing operations were industrial-scale, but these operations accounted for about one-third of production. Nearly 70 percent of feeder pig production was from the 11 percent of industrial-scale farms, with an average production of about 48,000 feeder pigs. Among the specialized hog producer types, contract production was more common on larger operations, but was also used by smaller producers. Nearly all industrial-scale feeder pig production was under contract, while nearly 60 percent of production on medium-sized operations was also under contract. On hog finishing operations, about 40 percent of production from small- and medium-sized operations was under contract, compared with about 70 percent of production from the large and industrial-scale operations.

Farm specialization in hog production increased with size across all producer types, with the value from hogs ranging from around 10 percent of total farm value of produc-

tion on small operations to around 90 percent on industrial-scale operations. Greater diversity among small operations is also apparent in typology classes that show significantly more producers generating the majority of household income from off-farm income sources. Operators of small hog enterprises were also generally older and carried less debt than larger operations. More than 60 percent of small farms also reported intentions of exiting hog production within the next 5 years, compared with very few of the industrial-scale operations. Production intentions reported in the 1998 ARMS support other data (USDA, NASS, *Hogs and Pigs*) that indicate more than 15,000 small- and medium-sized operations exited the industry between 1998 and 1999 (table 4). The data also suggest that many more small- and medium-sized operations will cease production in the next few years. The most striking illustration of this trend is in feeder pig production, where about 75 percent of small producers plan to be out of business by 2003, while 98 percent of industrial-scale operations plan to remain in business.

Performance by Size Group

Nearly all indicators of physical and economic performance improved as size of operation increased (table 6). Feed, labor, and capital, the three major inputs in hog production, were all used more efficiently on larger operations. Industrial-scale farrow-to-finish and hog finishing operations were nearly 40 percent more feed efficient on average than small operations, while industrial-scale feeder pig producers were about 65 percent more feed efficient than small feeder pig operations. Likewise, the labor requirement on the largest operations was only a fraction of that used by the smallest operations for all producer types. Differences in capital efficiency by size, as indicated by pigs weaned per sow and by production per unit of facility capacity, were also significant. Industrial-scale operations farrowed about five to seven more pigs per litter, and obtained about three times more litters per sow capacity and twice the market hogs per unit of finishing capacity than the small operations.

Table 5—Characteristics by size of operation for hog producer types, 1998

Item	Small	Medium	Large	Industrial-scale
Farrow-to-finish				
Percent of farms/sales and removals	49/8	41/39	7/21	3/32
Hogs and pigs sold or removed (head)	203	1,128	3,712	13,468
Head removed under contract (percent)	0	1**	id	7**
Farm production value from hogs (percent)	7	34	61	80
Farm typology (percent of farms):				
Retirement	9*	0	0	0
Residential lifestyle	28	1**	0	0
Operator age (percent less than 50 years)	44	51	76	44*
Farm debt-to-assets ratio	0.14	0.20	0.22	0.25
Exiting industry in 1 year or less (percent)	24*	34	9*	7*
Exiting industry in 5 years or less (percent)	62	51	16**	17**
Farrow-to-feeder pig				
Percent of farms/sales and removals	56/2	17/12	nr	11/69
Hogs and pigs sold or removed (head)	236	4,915	nr	47,999
Head removed under contract (percent)	0	59*	nr	98
Farm production value from hogs (percent)	11	58	nr	99
Farm typology (percent of farms):				
Retirement	3**	0	nr	0
Residential lifestyle	33*	id	nr	0
Operator age (percent less than 50 years)	26	62	nr	86*
Farm debt-to-assets ratio	0.12	0.28	nr	0.61*
Exiting industry in 1 year or less (percent)	51	20**	nr	0
Exiting industry in 5 years or less (percent)	73	31**	nr	id
Feeder pig-to-finish				
Percent of farms/sales and removals	39/5	39/25	18/35	5/36
Hogs and pigs sold/removed (head)	346	1,754	5,503	19,408
Head removed under contract (percent)	38**	45	74	66
Farm production value from hogs (percent)	14	40	73	90
Farm typology (percent of farms):				
Retirement	id	id	0	0
Residential lifestyle	17*	17*	2**	0
Operator age (percent less than 50 years)	40*	63	61	40*
Farm debt-to-assets ratio	0.20	0.27	0.37	0.39*
Exiting industry in 1 year or less (percent)	39*	13*	17*	id
Exiting industry in 5 years or less (percent)	65	29	32*	3**

Notes: id indicates insufficient data for legal disclosure; nr indicates not reported due to a limited sample size and a high coefficient of variation (CV); single (*) and double asterisks (**) indicate a CV between 25 and 50, and greater than 50, respectively.

Improvements in performance from the small to the industrial-scale operations were not linear, but rather were incrementally less with each size group (fig. 11). The largest efficiency gains on farrow-to-finish and feeder pig operations were made between the small and medium groups. Average costs on medium-sized farrow-to-finish operations were about 20 percent less than on small operations, while the average costs of feeder pig production fell 37 percent between the small and medium farms. Nearly all of the cost reduction by size for feeder pig production was achieved on medium-sized operations. However, the average cost of producing market hogs fell about 11-12 percent between medium and large farrow-to-finish and hog finishing operations. Average costs on these

farms fell another 2-5 percent between large and industrial-scale operations (fig. 11). These data suggest that production costs are reduced significantly by increasing the size of operations from relatively small sizes, but that there are still cost-reducing incentives for operations to grow to the industrial-scale size.

While average costs by size of operation reveal information about the relative competitiveness of various sized operations, they mask the underlying variation in costs. Cost variation among the farrow-to-finish operations in each size group is illustrated in figure 12 (p. 20). The variation in cost was greatest among the small hog operations, and least among the large and industrial-scale operations.

Table 6—Performance by size of operation for hog producer types, 1998

Item	Small	Medium	Large	Industrial-scale
Farrow-to-finish				
Litters farrowed per sow (number)	1.88	2.15	2.04	2.09
Pigs weaned per litter (head)	7.24	8.05	8.68	8.77
Pigs weaned per sow (head)	13.64	17.34	17.74	18.30
Weaning age (days)	40	28	22	18
Weaning weight (pounds)	29	18	14	12
Feed efficiency (pounds fed per cwt gain)	498	403	379	300
Labor efficiency (hours per cwt gain)	1.82	0.98	0.49	0.27
Litters farrowed per sow capacity	1.40	3.09*	5.75	6.24*
Farrowing facility age (years)	18	14	16	10
Hogs finished per head capacity	1.38	2.16	2.57	3.26
Finishing facility age	20	17	12	8
Production costs (dollars per cwt gain):				
Feed costs	26.29	25.14	22.82	21.20
Operating costs	32.94	32.18	30.75	30.02
Ownership costs	24.87	13.66	10.05	8.92
Total operating and ownership costs	57.81	45.85	40.80	38.94
Farrow-to-feeder pig				
Litters farrowed per sow (number)	2.09	2.05	nr	2.19
Pigs weaned per litter (head)	7.09	8.68	nr	10.01
Pigs weaned per sow (head)	14.80	17.77	nr	21.92
Weaning age (days)	33	21	nr	19
Weaning weight (pounds)	24	14	nr	13*
Feed efficiency (pounds fed per cwt gain)	777*	349	nr	260*
Labor efficiency (hours per cwt gain)	4.14	1.82	nr	0.30*
Litters farrowed per sow capacity	2.65*	4.32*	nr	7.71**
Farrowing facility age (years)	19	9	nr	5
Production costs (dollars per cwt gain):				
Feed costs	45.55	29.62	nr	29.34
Operating costs	64.36	45.09	nr	52.11
Ownership costs	47.87	27.45	nr	21.75
Total operating and ownership costs	104.81	66.01	nr	62.97
Feeder pig-to-finish				
Feed efficiency (pounds fed per cwt gain)	389	342	265	247
Labor efficiency (hours per cwt gain)	0.86	0.39	0.19	0.12
Hogs finished per head capacity	1.30	1.73	2.14	2.45*
Finishing facility age	20	13	6	4
Production costs (dollars per cwt gain):				
Feed costs	23.27	22.52	19.40	18.26
Operating costs	43.24	43.08	38.80	38.80
Ownership costs	12.35	8.51	6.41	5.65
Total operating and ownership costs	55.60	51.59	45.21	44.45

Notes: id indicates insufficient data for legal disclosure; nr indicates not reported due to a limited sample size and a high coefficient of variation (CV); single (*) and double asterisks (**) indicate a CV between 25 and 50, and greater than 50, respectively.

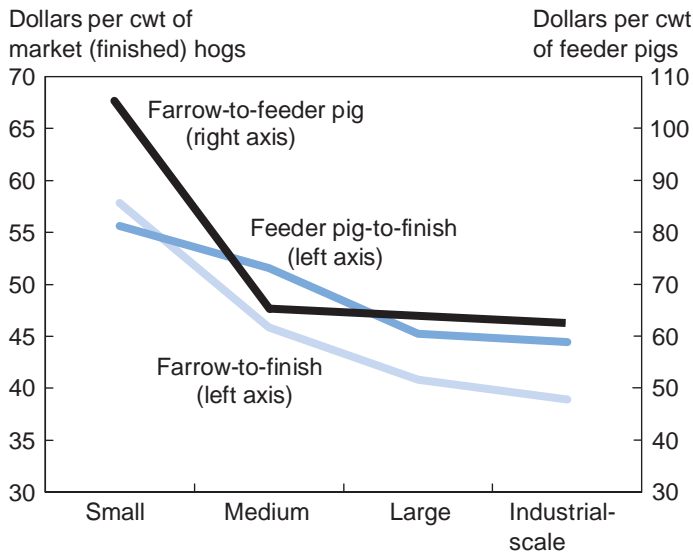
This result coincides with the greater diversity among small producers relative to other producers. The cost distributions also show that despite higher average costs among the small- and medium-sized groups, many of these operations produce at a cost that is competitive with larger operations. For example, at a hog price of \$40 per cwt, 19 percent of small producers covered production costs in 1998, compared with over 50 percent of the large and industrial-scale producers (fig. 12). However, this 19

percent corresponded to about 17,000 small operations, compared with about 4,000 large and industrial-scale operations (see table 4 for 1998 farm numbers). Therefore, there is substantial variation in production costs that cannot be attributed to size of operation. This suggests that the managerial ability of individual hog producers is likely to be as important as size economies to lowering the costs of hog production.

Figure 11

Production costs by size of operation for hog producer types, 1998

Average production costs declined as size of operation increased, with most of the reduction occurring between small to medium and medium to large operations.



Source: 1998 Agricultural Resource Management Survey.

Regional Diversity

As the structure of the hog industry has changed, so has its geography. Hog production has historically been concentrated in Corn Belt States where an abundant supply of corn provided a relatively cheap source of hog feed. However, during the 1980s and 90s, the growth and concentration of hog production was the most dramatic in nontraditional areas (Hubbell and Welsh). In North Carolina, the inventory of hogs and pigs more than doubled between 1987 and 92, as the State went from 6th to rank 2nd in total hog inventory. The hog inventory in North Carolina nearly doubled again between 1992 and 1997 (fig. 13).⁹ Recently, the hog industry has moved aggressively into Western States, most notably in Oklahoma where the hog inventory increased more than 500 percent between 1992 and 1997.

Rapid growth and concentration in the North Carolina hog industry has been attributed to the development of “supply chains” that more closely link producers, packers, and consumers (Drabenstott).¹⁰ The prominent feature of supply chains is contracting. Hog production in North Carolina expanded almost exclusively from the use of con-

⁹ In 1999, the total pig crop (i.e., pigs farrowed) in North Carolina exceeded Iowa’s.

tracting by a few large integrators who developed pork supply chains. Recent expansion into Western States cannot be attributed to traditional factors, such as the availability of low-cost feed grains, or to the development of supply chains. A possible reason for growth of the hog industry in Western States is the presence of open space and a relatively low population density, features that provide flexibility in managing animal waste (Drabenstott). Growing concerns over waste management and odor in North Carolina and eastern Corn Belt States, areas with much higher population densities, have resulted in tighter state environmental regulations.¹¹ In many of these areas, the State and local governments have become more actively involved with regulating hog farming, creating a more uncertain regulatory environment. Research by Abdalla and Mo suggests that this uncertainty has likely encouraged investment in the hog industry to look elsewhere. Recent evidence suggests that Western States have attracted hog production using traditional business recruitment and retention tools such as tax breaks and less stringent environmental regulation (Roe, Irwin, and Sharp). However, other research finds no evidence that increasing environmental regulation in a State has had a detrimental effect on hog production in that State (Metcalf). Whatever has caused the current geographic dispersion of hog production, it is likely that some interplay between economic conditions and environmental regulations will determine future geographic movements in the industry.

This report explores regional diversity in hog production by comparing characteristics of different producer types in the major production regions. Other studies have suggested that operations in the traditional Corn Belt production areas have a natural competitive advantage, but that the advantage has been overcome in other areas through investment in new technologies and from economies of size (Onal, Unnevehr, and Bekric). ERS Farm Resource Regions (Heimlich) will be used as the basis for the regional delineation (fig. 14). Among these regions, the Heartland is the region where hog production has traditionally been concentrated, including the Corn Belt, while the Southern Seaboard includes the areas of rapid growth during the 1980s and 1990s. The Western Region, defined to include the Prairie Gateway, Northern Great Plains, and

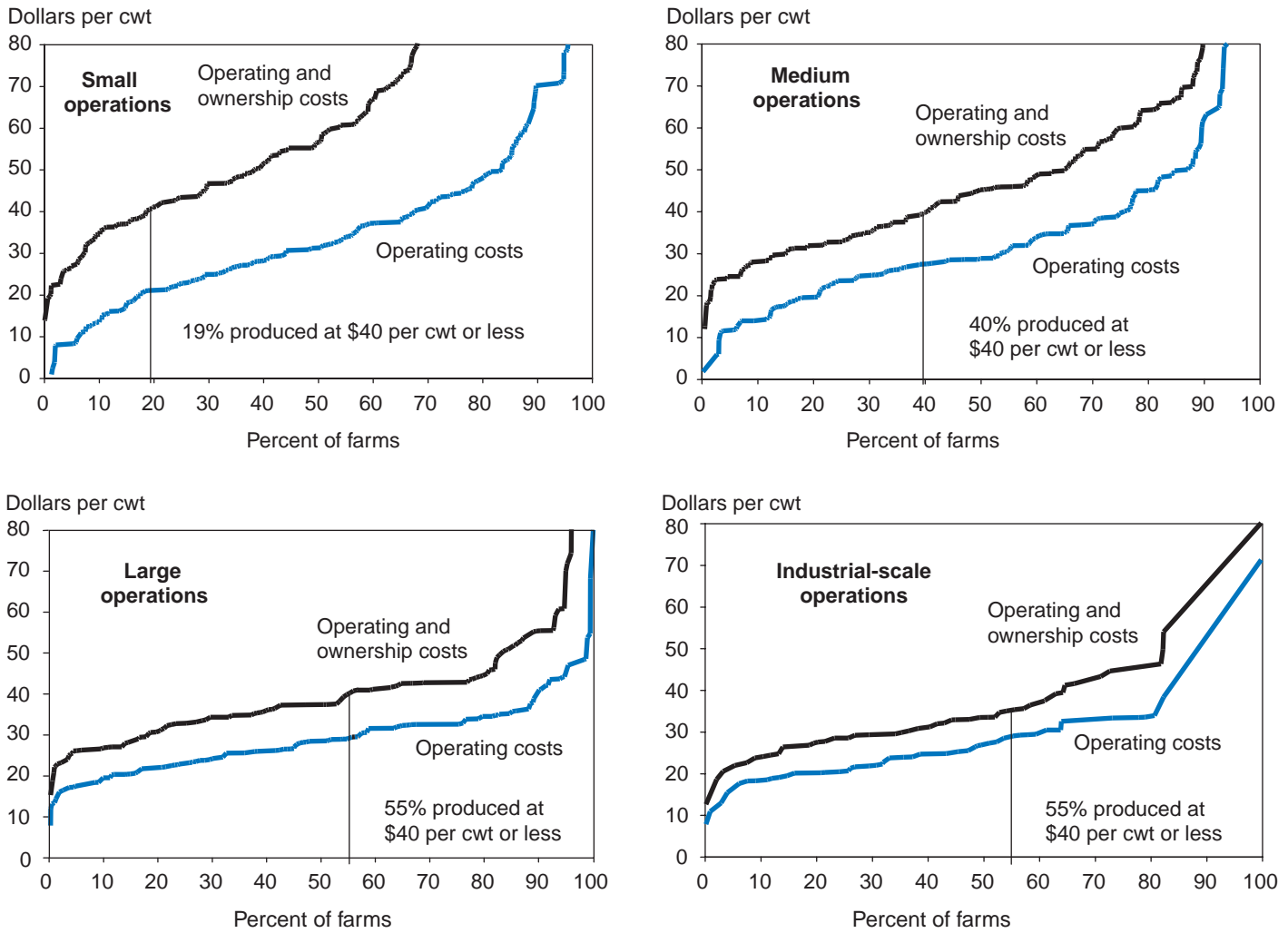
¹⁰ A supply chain represents the many components of production, processing, distribution, and marketing aligned into a single system for the purpose of meeting consumer demand. A major advantage of supply chains is that they provide for a more rapid response to changes in consumer demand

¹¹ Growing environmental concerns in North Carolina resulted in a moratorium on the construction of new facilities in 1997 (Feitshans), causing the rapid growth in hog production during much of the 1990s to plateau in recent years.

Figure 12

Farrow-to-finish production cost distributions by size of operation, 1998

The variation in costs among small hog operations was much greater than among other operations, with the least variation in costs among the large and industrial-scale operations.



Source: 1998 Agricultural Resource Management Survey.

the Basin and Range, is where expansion in hog production has been most recent.

Structural Characteristics by Region

Farrow-to-finish hog production in 1998 was highly concentrated in the Heartland, with about three-fourths of the farms and production, compared with less than 10 percent in the other regions (table 7). Farrow-to-finish operations were about the same size in each region, with little contract activity in any of the regions. More than 80 percent of these operations had been in business more than 10 years and most had operators that were more than 50 years of age. The main differences between farrow-to-finish growers in each region was that they operated much

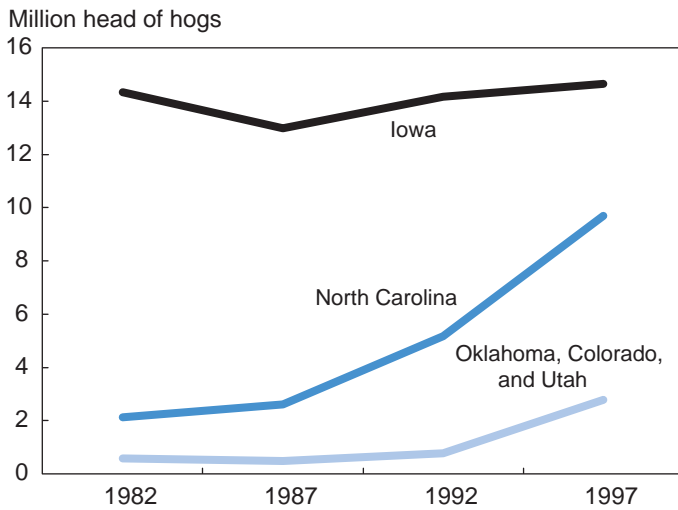
larger farms in the Western regions and the Heartland than in the Southern Seaboard, and that significantly more Heartland producers grew their own corn.

Regional differences were more apparent among the specialized feeder pig and finished hog producers. Feeder pig producers in the Southern Seaboard were significantly larger than those in the Heartland (13,753 vs. 8,960 head), while nearly all feeder pigs in both regions were removed under contract from highly specialized feeder pig operations. Despite the large average size of feeder pig operations, a majority of feeder pig producers in both regions had small hog operations (fig. 15) that had been in business more than 10 years. This means that there was considerable variation in the size distribution of feeder pig

Figure 13

Hog inventories in selected States, 1982-97

Hog numbers remained stable in Iowa during 1982-97, but grew rapidly in North Carolina and have been growing in Western States since 1992.



Source: Census of Agriculture, various years.

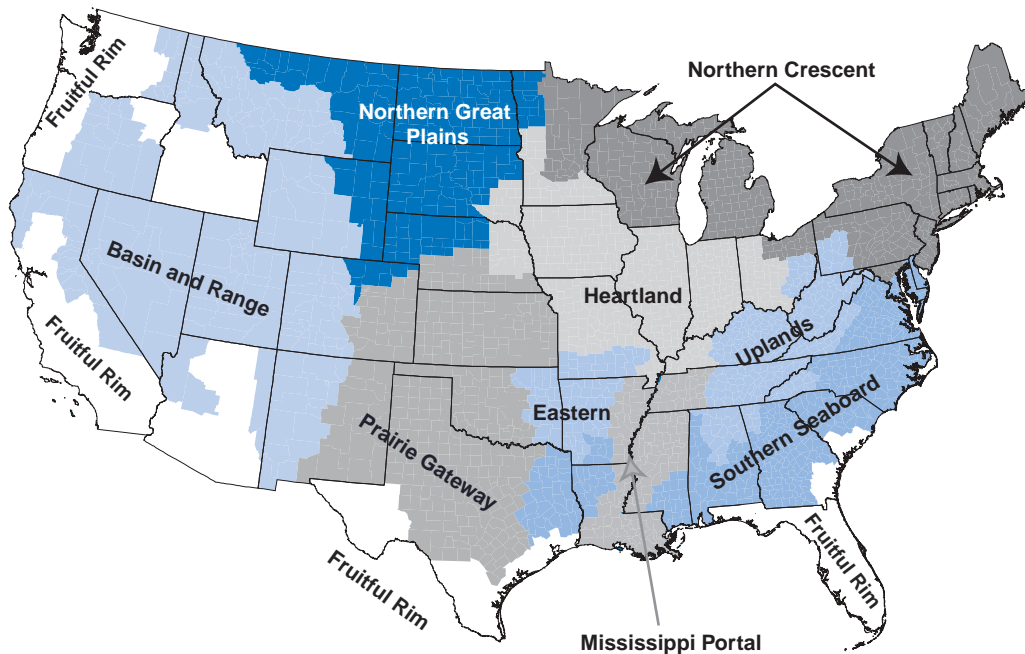
farms, with a few “mega-operations” responsible for inflating the per farm average. The relatively large proportion of Heartland producers under 50 years of age and the higher debt-to-assets ratio suggests that the investment in large-scale feeder pig production in this region has been more recent than in the Southern Seaboard. The farrow-to-feeder pig farms in both regions were highly concentrated on a relatively small land area compared with that on farms producing finished hogs.

Finished hog producers in the Southern Seaboard were more than 3 times larger than in the Western regions and nearly 6 times larger than in the Heartland. Over 70 percent of Southern Seaboard farms had large or industrial-scale operations (fig. 15) that were highly specialized, contract operations. In contrast, independent operations were predominant among finished hog producers in the Western regions. Producers in the Western regions were also younger and had a higher debt-to-assets ratio, suggesting a recent investment in production facilities. Half of the finished hogs in the Heartland were removed under contract, and nearly all Heartland operations also grew a substantial amount of corn (table 7). Finished hog production in the Southern Seaboard was much more concen-

Figure 14

Farm Resource Regions

Hog production has traditionally been concentrated in the Heartland, but during the 1980s and 90s expanded rapidly in the Southern Seaboard and more recently in Western regions, particularly in the Prairie Gateway and Basin and Range.



Source: Heimlich.

Table 7—Characteristics by region for hog producer types, 1998

Item	Heartland	Southern Seaboard	Western regions ¹
Farrow-to-finish			
Percent of farms/sales and removals	74/76	5/4	9/9
Hogs and pigs sold or removed (head)	1,245	1,145	1,272*
Head removed under contract (percent)	3*	3**	0
Farm production value from hogs (percent)	47	61	45*
In the hog business (percent of farms):			
Less than 10 years	6	15*	12**
10 years or more	94	85	88
Operator age (percent less than 50 years)	50	35	49
Farm debt-to-assets ratio	0.20	0.09	0.20
Farm land area (acres operated)	474	236	709*
Farms producing corn (percent of farms)	85	49	46
Corn harvested (acres per reporting farm)	213	55*	159*
Farrow-to-feeder pig			
Percent of farms/sales and removals	49/60	15/29	nr
Hogs and pigs sold or removed (head)	8,960**	13,753*	nr
Head removed under contract (percent)	80**	99	nr
Farm production value from hogs (percent)	91*	84	nr
In the hog business (percent of farms):			
Less than 10 years	21**	41	nr
10 years or more	79	59	nr
Operator age (percent less than 50 years)	70	28*	nr
Farm debt-to-assets ratio	0.51*	0.29	nr
Farm land area (acres operated)	191*	108*	nr
Farms producing corn (percent of farms)	35*	16*	nr
Corn harvested (acres per reporting farm)	78*	22**	nr
Feeder pig-to-finish			
Percent of farms/sales and removals	72/51	8/32	8/11
Hogs and pigs sold/removed (head)	1,959	10,691	3,492*
Head removed under contract (percent)	50	83	23**
Farm production value from hogs (percent)	46	74	52*
In the hog business (percent of farms):			
Less than 10 years	11*	59	26*
10 years or more	89	41	74
Operator age (percent less than 50 years)	51	47	65
Farm debt-to-assets ratio	0.29	0.23*	0.39*
Farm land area (acres operated)	524	193	725
Farms producing corn (percent of farms)	92	27	65
Corn harvested (acres per reporting farm)	253	34*	206*

¹Includes the Prairie Gateway, Northern Great Plains, and the Basin and Range (see fig. 14).

Notes: nr indicates not reported due to a limited sample size and a high coefficient of variation (CV); single (*) and double asterisks (**) indicate a CV between 25 and 50, and greater than 50, respectively.

trated on a smaller land base than in the Heartland and Western regions.

Performance Characteristics by Region

Most performance measures were not significantly different among the farrow-to-finish operations in each region, but Southern Seaboard and Western producers were more feed efficient than in the Heartland (table 8). Greater feed efficiency in the Southern Seaboard may be due to several factors, including the use of more technologically advanced facilities for both farrowing and finishing, and

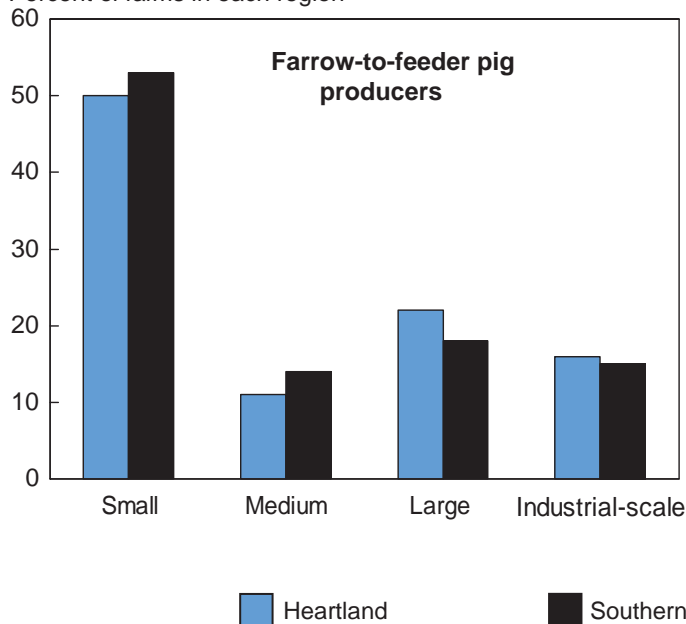
lighter sale/removal weights. Despite being more feed efficient, the average feed cost on Southern Seaboard operations was not significantly different than that in the Heartland. This can be attributed to corn prices that in 1998 were nearly 50 cents per bushel higher in North Carolina than in Iowa (fig. 16). In contrast, better feed efficiency on operations in the Western regions resulted in about \$4 per cwt lower feed costs than in the Heartland because the regional difference in 1998 corn prices was not as substantial.

Figure 15

Regional distribution of hog farms by size of operation, 1998

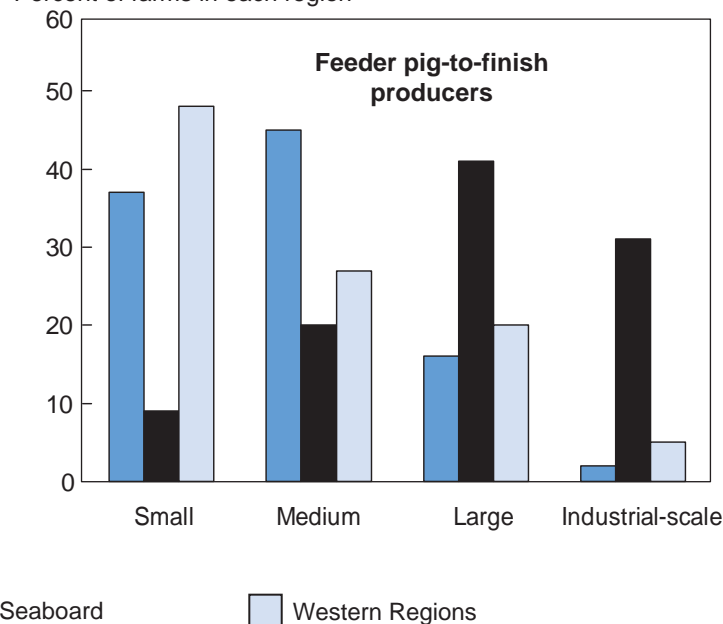
A majority of feeder pig producers in the Heartland and Southern Seaboard were small producers.

Percent of farms in each region



Over 70 percent of hog finishers in the Southern Seaboard were large or industrial-scale operations.

Percent of farms in each region



Source: 1998 Agricultural Resource Management Survey.

Several performance measures differed between feeder pig producers in the Heartland and Southern Seaboard. Heartland growers farrowed more litters per sow and weaned about two more pigs per sow than in the Southern Seaboard. These producers also weaned pigs earlier at lighter weights, enabling them to farrow more litters per unit of capacity. However, Southern Seaboard growers were more feed efficient than in the Heartland and produced hogs at a lower feed cost despite higher corn prices in the South (fig. 16). Southern Seaboard growers were significantly larger and almost exclusively contract operations that had feed provided by large integrators who purchased and/or processed feed in volume. Despite less intensive use of the production facilities, feeder pig producers in the Southern Seaboard had lower capital ownership costs that reflect greater size economies, but also reflect a difference between the types of facilities needed in the warmer Southern climate versus the colder Heartland.

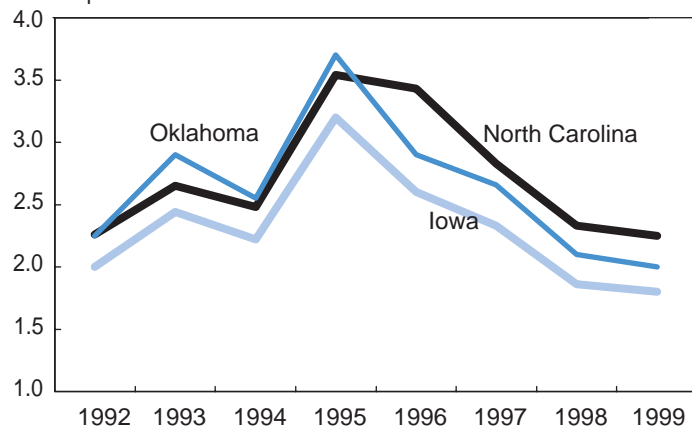
Finished hog operations in the Southern Seaboard also had a significant competitive advantage over operations in the other regions because of lower feed and capital costs. Again, it appears that the cost advantages associated with large and industrial-scale operations in the South were able to overcome the inherent regional differences in feed prices. Hog finishing operations in the Southern Seaboard

were about 25 percent more feed efficient than in the other regions, owing in part to more current production technologies and lighter sales/removals weights. Capital ownership costs were also significantly lower as the fixed

Figure 16
Corn prices in selected States, 1992-99

Average corn prices in Iowa were nearly 50 cents per bushel lower than in North Carolina, and about 25 cents lower than in Oklahoma during 1998.

Dollars per bushel



Source: USDA, NASS, *Agricultural Prices*, various years.

Table 8—Performance by region for hog producer types, 1998

Item	Heartland	Southern Seaboard	Western regions ¹
Farrow-to-finish			
Litters farrowed per sow (number)	2.13	2.15	2.01
Pigs weaned per litter (head)	8.29	8.40	8.70
Pigs weaned per sow (head)	17.63	18.08	17.47
Weaning age (days)	32	42	34
Weaning weight (pounds)	22	28	23
Sale/removal weight (pounds)	252	242	249
Feed efficiency (pounds fed per cwt gain)	376	324	338
Labor efficiency (hours per cwt gain)	0.72	0.66	0.67*
Litters farrowed per sow capacity	3.99	3.94*	4.53*
Farrowing facility age (years)	16	10	13
Hogs finished per head capacity	2.37	1.74*	2.79*
Finishing facility age	15	10	13
Production costs (dollars per cwt gain):			
Feed costs	24.10	25.00	19.95
Operating costs	31.79	34.52	28.72
Ownership costs	12.11	15.81	11.68
Total operating and ownership costs	43.91	50.33	40.40
Farrow-to-feeder pig			
Litters farrowed per sow (number)	2.25	2.08	nr
Pigs weaned per litter (head)	9.74	9.56	nr
Pigs weaned per sow (head)	21.94	19.93	nr
Weaning age (days)	24	32	nr
Weaning weight (pounds)	17	26	nr
Feed efficiency (pounds fed per cwt gain)	317**	292	nr
Labor efficiency (hours per cwt gain)	0.73**	0.62*	nr
Litters farrowed per sow capacity	4.86**	3.31**	nr
Farrowing facility age (years)	5*	7*	nr
Production costs (dollars per cwt gain):			
Feed costs	32.30	25.96	nr
Operating costs	56.37	48.31	nr
Ownership costs	28.68*	20.13	nr
Total operating and ownership costs	85.05	68.44	nr
Feeder pig-to-finish			
Sale/removal weight (pounds)	254	246	250
Feed efficiency (pounds fed per cwt gain)	307	228	309
Labor efficiency (hours per cwt gain)	0.31	0.12	0.24*
Hogs finished per head capacity	1.93	2.41	1.70*
Finishing facility age	11	6	5**
Production costs (dollars per cwt gain):			
Feed costs	20.70	18.67	20.14
Operating costs	41.44	37.93	41.31
Ownership costs	7.27	5.38	8.94
Total operating and ownership costs	48.71	43.31	50.25

¹Includes the Prairie Gateway, Northern Great Plains, and the Basin and Range (see fig. 14).

Notes: nr indicates not reported due to a limited sample size and a high coefficient of variation (CV); single (*) and double asterisks (**) indicate a CV between 25 and 50, and greater than 50, respectively.

capital investment was spread over many more units of production on operations in the Southern Seaboard.

These findings demonstrate that the comparative disadvantages an area may have in producing hogs can be overcome with innovative technologies and business arrangements, making the hog industry highly mobile and able to move to locations where market and/or regulatory condi-

tions are more favorable. This mobility also means that hog production could easily locate in other areas of the U.S., or move out of the country should market and/or regulatory conditions warrant.

Contract Production

A widely held view is that rapid restructuring in U.S. hog production during the 1980s and 1990s came about, in large part, from the expanding use of contract production arrangements. Contract production is believed to have aided the expansion of hog operations by facilitating the accumulation of capital necessary for operations to achieve unprecedented size. Research by Barry et al. lends support to this view, indicating that lenders have responded to the risk-return tradeoff between independent and contract production by allowing greater borrowing capacity to producers under contracts. New entrants to hog production and producers contemplating expansion were, on average, found to have access to more financing with a production contract. Boehlje and Ray analyzed the impact of the availability of additional financing in contract production, and found that it enhanced a producer's return on equity sufficiently to justify entering into the contract arrangement.

Contractors have regarded contract production as an effective means to achieve economies of size in hog production, while requiring minimal capital and labor. In a survey of large hog contractors, the increased financial leverage resulting from substituting grower capital for contractor capital was the most frequently mentioned advantage of contract production arrangements (Lawrence, Grimes, and Hayenga). Other important advantages mentioned in the survey were the mitigation of environmental/regulatory problems and the sourcing of motivated labor. Handling and disposal of hog manure has most often been the responsibility of growers on contract operations. The loss of operational control was the leading disadvantage reported by contractors. Having to pay for grower assets and disagreements with growers were also cited by contractors as important disadvantages of contract production.

Growers have embraced contracting as a means of reducing risk, accessing capital, and stabilizing income. Survey results suggest that risk reduction is the leading reason that producers enter into contract arrangements, followed by a lack of capital and the need for more income (Wind-Norton and Kliebenstein). Several studies have demonstrated that risk-averse producers prefer contracting to independent production (Martin; Johnson and Foster; Parcell and Langemeier). However, there is a risk/expected-return tradeoff involved with hog production contracts as growers trade potentially higher returns for risk reduction. Another tradeoff contract growers experience is the loss of control over such aspects of their operation as management responsibilities. There is evidence showing that, for some hog producers, autonomy is more important than

risk reduction in selecting between contract and independent business arrangements (Gillespie and Eidman). This may explain, in part, why the growth of contracting has varied among different areas of the country, and why new entrants to the hog industry have been more attracted to contracting than have established independent producers.

This report compares contract and independent feeder pig and hog finishing operations by examining their relative characteristics and performance.¹² It also examines the contractor-grower relationship by summarizing information on structural characteristics, contract terms, and incentive mechanisms for different types of contractors.

Structural Characteristics by Business Arrangement

About 19 percent of feeder pig producers and 34 percent of finished hog operations produced under contract in 1998, but these operations accounted for 82 percent of feeder pigs and 63 percent of finished hogs (table 9). Most contract feeder pig farms were highly specialized industrial-scale operations with an average size of more than 30,000 pigs removed (fig. 17). In contrast, nearly 70 percent of independent feeder pig farms were diversified small operations, with an average size of about 1,500 head sold in 1998. This difference is also reflected in the typology of farm operations. Among independent feeder pig producers, 23 percent were residential lifestyle farms and nearly half were farm occupation/lower sales (see Glossary, p. 43). Almost three-fourths of contract feeder pig operations were very large family farms. Contract feeder pig producers also had about 20 times the number of pigs concentrated on about a third of the land area held by independent operations, making manure management a much greater issue for contract feeder pig producers.

This size differential between contract and independent operations was also apparent, but not as pronounced, among hog finishing operations. Contract hog finishing operations had an average of more than 5,000 hogs removed in 1998, compared with about 1,500 head sold from independent operations (table 9). The distribution of hog finishing farms by typology shows that 67 percent of contract operations were among the large farm groups, while 64 percent of independent operations were in the small farm categories. Also, the average size of hog finishing operations increased much more among

¹² The characteristics and performance of contract and independent farrow-to-finish operations were not compared because of limited data on contract operations. Less than 1 percent of farrow-to-finish operations produced hogs under contract and these contract operations accounted for only about 3 percent of total hog sales and contract removals from farrow-to-finish operations.

Table 9—Characteristics by business arrangement for hog producer types, 1998

Item	Contract operations	Independent operations
Farrow-to-feeder pig		
Percent of farms/sales and removals	19/82	81/28
Hogs and pigs sold or removed (head)	31,237*	1,531*
Farm production value from hogs (percent)	96	50
Farm land area (acres operated)	71**	229
Farm typology (percent of farms):		
Retirement	0	2**
Residential lifestyle	id	23*
Farming occupation-lower sales	0	48
Farming occupation-higher sales	8**	17*
Large family farm	16**	6**
Very large family farm	74	3*
In the hog business (percent of farms):		
Less than 10 years	72	8*
10 years or more	28**	92
Operator age (percent less than 50 years)	68*	44*
Farm debt-to-assets ratio	0.54*	0.19
Exiting industry in 1 year or less (percent)	10**	48
Exiting industry in 5 years or less (percent)	14**	65
Feeder pig-to-finish		
Percent of farms/sales and removals	34/63	66/37
Hogs and pigs sold or removed (head)	5,154	1,452
Farm production value from hogs (percent)	66	44
Farm land area (acres operated)	403	545
Farm typology (percent of farms):		
Retirement	id	id
Residential lifestyle	15*	13*
Farming occupation-lower sales	5**	14*
Farming occupation-higher sales	13*	37
Large family farm	37	22*
Very large family farm	30	14
In the hog business (percent of farms):		
Less than 10 years	37	9
10 years or more	63	91
Operator age (percent less than 50 years)	65	47
Farm debt-to-assets ratio	0.33	0.25
Exiting industry in 1 year or less (percent)	3*	34
Exiting industry in 5 years or less (percent)	21*	54

Notes: id indicates insufficient data for legal disclosure; single (*) and double asterisks (**) indicate a coefficient of variation between 25 and 50, and greater than 50, respectively.

contract operations between 1992 and 1998 than among independent operations (fig. 18). Contract operations were about 3 times larger in 1998 than in 1992, increasing from an average of about 1,700 head to more than 5,000 head removed. The average size of independent operations doubled, but in absolute terms the average size was only 1,400 head in 1998.

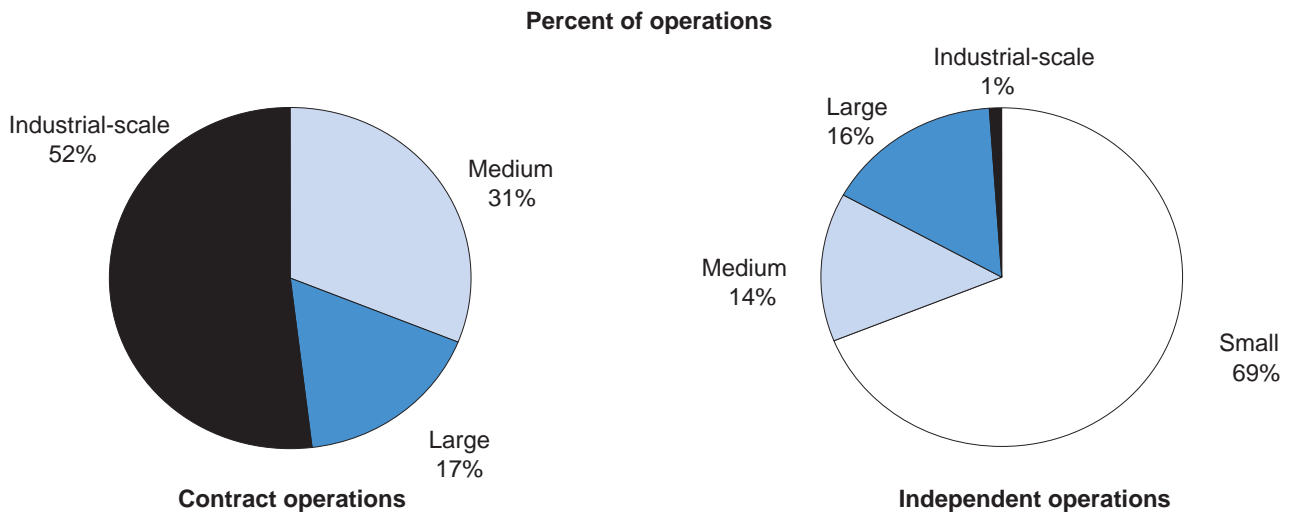
Other structural characteristics of contract and independent operations suggest that contract arrangements have mainly appealed to recent and younger entrants to the hog industry. More than 70 percent of contract feeder pig producers had been producing hogs less than 10 years in

1998, while over 90 percent of independent producers had been in business 10 years or more. More than 65 percent of the contract producers were less than 50 years old, compared with less than 50 percent of independent producers. The higher average debt-to-assets ratio for contract operations suggests that the investment in hog production facilities has been more recent among these producers. Also, a significantly higher proportion of independent producers reported plans to exit hog production within the next 5 years than did the contract producers, indicating that the trend toward an increasing proportion of total hogs produced under contract is likely to continue.

Figure 17

Size distribution of feeder pig operations by business arrangement, 1998

More than half of contract feeder pig operations were industrial scale, while nearly 70 percent of independent operations were small in size.



Source: 1998 Agricultural Resource Management Survey.

Performance by Business Arrangement

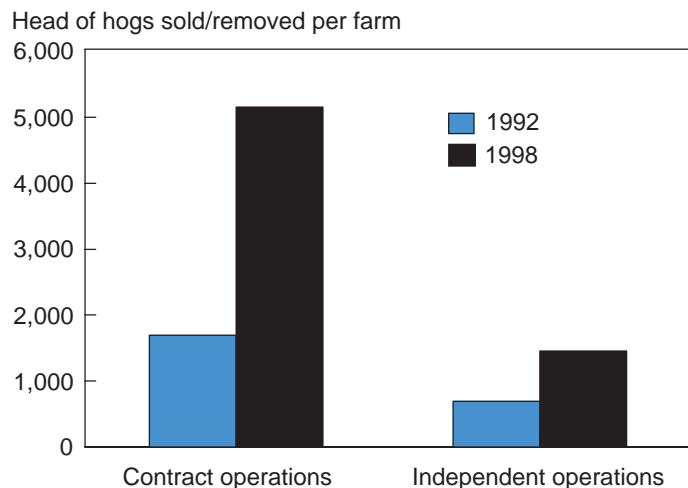
The differences in performance between the contract and independent feeder pig operations in 1998 were dramatic, and mirror differences in performance between small and industrial-scale operations (table 10). Contract operations farrowed more litters per sow and weaned about 1.2 more pigs per litter. This translated into nearly four more pigs per sow on average than on independent operations. This was possible because pigs were weaned earlier and at a lighter weight, allowing sows to be rebred sooner. This also meant that farrowing facilities were emptied and filled more often, so more litters were farrowed per crate. Feed efficiency was also much greater on contract operations, resulting in feed costs that were \$8 per cwt less than on independent operations. Differences in feed efficiency can be attributed to the better reproductive performance that produced more pigs per sow and per pound of sow feed, and to significantly lower contract removal weights compared with the sale weights on independent operations. Ownership costs were significantly lower on contract feeder pig operations partly because capital assets (the breeding herd and facilities) were used more intensively, and due to the cost advantages of large-scale production. Total production costs were about 20 percent less on contract feeder pig operations than on independent operations.

Economic performance was also greater for contract hog finishers than for independent operations due again to bet-

Figure 18

Size of hog finishing operations by business arrangement, 1992 and 1998

Average size of contract hog finishing operations more than tripled between 1992 and 1998, while size of independent operations only doubled.



Source: 1992 Farm Costs and Returns Survey; 1998 Agricultural Resource Management Survey.

ter feed and capital use efficiency. Contract operations used about 30 percent less feed than independent operations, and produced about 20 percent more hogs per head of facility space. Newer production technologies and differences in management approach may be behind these efficiencies. As a result, total costs were more than \$7 per

Table 10—Performance by business arrangement for hog producer types, 1998

Item	Contract operations	Independent operations
Farrow-to-feeder pig		
Litters farrowed per sow (number)	2.21	2.06
Pigs weaned per litter (head)	9.80	8.63
Pigs weaned per sow (head)	21.68	17.76
Weaning age (days)	19	30
Weaning weight (pounds)	14	21
Sale/removal weight (pounds)	35	46
Feed efficiency (pounds fed per cwt gain)	266	491
Labor efficiency (hours per cwt gain)	0.47*	2.04
Litters farrowed per sow capacity	4.52**	1.82**
Farrowing facility age (years)	7	7**
Production costs (dollars per cwt gain):		
Feed costs	28.44	36.94
Operating costs	52.11	56.50
Ownership costs	22.94	35.68
Total operating and ownership costs	75.05	92.18
Feeder pig-to-finish		
Sale/removal weight (pounds)	250	254
Feed efficiency (pounds fed per cwt gain)	242	352
Labor efficiency (hours per cwt gain)	0.15	0.41
Hogs finished per head capacity	2.21	1.79
Finishing facility age	7	12
Production costs (dollars per cwt gain):		
Feed costs	19.48	22.65
Operating costs	38.31	42.98
Ownership costs	5.94	8.63
Total operating and ownership costs	44.25	51.60

Notes: Single (*) and double asterisks (**) indicate a coefficient of variation between 25 and 50, and greater than 50, respectively.

hundredweight lower on contract operations, a savings of about 14 percent compared with independent operations.

Contract Arrangements for Finishing Hogs

Details of the hog contract arrangement used on hog finishing operations by contractor type are shown in table 11. About a third of all farms finishing hogs under contract were with each type of contractor, but integrators were responsible for the majority of contract production (56 percent).¹³ The average size among growers for integrators was more than 9,000 head, nearly triple that for the other contractor types. Integrators were also most active in the Southern Seaboard region, where 65 percent

of their growers were located. Nearly 90 percent of growers for vertically integrated firms or other farmers were located in the Heartland region.

Integrators appeared to have exercised more influence over grower operations than did the other contractor types. Nearly 80 percent of integrators provided the facility specifications, compared with only about a quarter of the other contractors. Integrators also had a larger role in transporting hogs, monitoring herd health, and managing animal waste than the other contractors. Managing animal waste was likely a bigger issue among the growers for integrators because these large operations were located on much less acreage. While integrators provided more influence and production inputs, they also paid growers about 10 percent less in production fees than did the other contractors. The fee paid to growers by integrators depended mostly on performance bonuses, while vertically integrated firms used all types of fee systems and most other farmers paid a fixed fee.

Growers for integrators had been with their contractor the longest, but tended to be younger and in the hog business

¹³ These data were collected in 1998 prior to considerable consolidation among the top hog contractors. During 1999 and 2000, Smithfield Foods acquired other large hog contractors including Carroll's Foods and Murphy Family Farms, previously the largest hog producer in the U.S. These acquisitions made Smithfield Foods the largest hog producer, with more than 3 times the sows as the next largest operation (Successful Farming). Smithfield Foods is also the largest pork processor and has increasingly combined hog production and processing in a vertical integration strategy (Smithfield Foods News Release).

Table 11—Contractor and grower characteristics by contractor type, 1998

Item	Integrators	Vertically integrated firms ¹	Other farmers
Feeder pig-to-finish			
Percent of farms/sales and removals	31/56	33/24	25/15
Hogs and pigs sold or removed (head)	9,245	3,680*	3,141
Farm production value from hogs (percent)	83	53*	55
Farm land area (acres operated)	285	504	416
Location (percent of farms):			
Heartland	22*	89	83
Southern Seaboard	65	1**	1**
<i>Contract characteristics:</i>			
Contractor services (percent of farms)			
Finances facility construction	10*	1**	7**
Provides facility specifications	79	25**	22*
Transports hogs to and from operation	99	72	94
Transports feed	100	99	93
Monitors herd health	90	61*	73
Assists with waste management	60	48*	18*
Fees paid by contractor (\$ per head)	10.41	11.53	11.55
Fee payment basis (percent of farms):			
Fixed fee	41	30*	66
Fixed fee with bonus	57	43*	29*
Other	2*	27**	5**
<i>Grower Characteristics:</i>			
Years with current contractor	6	3	5*
In the hog business (percent of farms):			
Less than 10 years	62	32**	24*
10 years or more	38	68*	76
Operator age (percent less than 50 years)	53	75	75
Farm typology (percent of farms):			
Retirement	id	0	0
Residential lifestyle	5*	22**	22*
Farming occupation-lower sales	id	0	id
Farming occupation-higher sales	10*	6**	17*
Large family farm	29	45*	42*
Very large family farm	48	27**	14*

¹Includes input suppliers (e.g., feed companies) and output processors (e.g., packers).

Notes: Statistics are the average across grower operations with each type of contractor; id indicates insufficient data for legal disclosure; single (*) and double asterisks (**) indicate a coefficient of variation between 25 and 50, and greater than 50, respectively.

a shorter time than other growers. This suggests that integrators more often attracted less experienced producers, while the other types of contractors likely appealed more to formerly independent producers. Also, growers for

integrators tended to have very large, specialized operations. In contrast, more than 20 percent of the growers for vertically integrated firms and other farmers also had a primary occupation off the farm.